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"The Missing Technician"

This is the title of a book* written by a director of an advertising agency with the object of bringing home to British manufacturers that quite often their businesses have suffered from the non-inclusion on their staff of an industrial designer. The author by the very nature of his calling and interests is somewhat of an industrial revolutionary, but is no worse for that. He holds Pritchard (the designer of the iron bridge at Coalbrookdale); Sir Joseph Paxton (of Crystal Palace fame); Stephenson and Sir Benjamin Baker in higher esteem than Ruskin and William Morris. His outlook on the subject of industrial design and all that it means, can perhaps best be shown by his own illustrated example. He uses for this purpose the development of the H.M.V. electric iron—a foundry job. The first attempt was the conventional flat iron, hollowed out and fitted inside with coils of resistance wires. Then followed the inclusion of a gadget at the rear so that when not in use it could be placed on end. At this stage a distinguished architect was consulted, and as the result a streamlined push-button controlled glazed firebrick job was produced which has been an industrial success.

The author of the book shows the reader just how this system can be applied to a wide range of productions, a number of which are still the virtual monopoly of the foundry industry. His system is fundamentally that every factory needs the services of an industrial designer or designers. This individual must work through a committee, upon which there must be representation from the manufacturing and sales departments.

It is with a feeling of satisfaction that we record that the author has not left the reader in the air, as to the finding and selection of these industrial designers, for whilst he has not printed a list of individuals, he has indicated quite clearly where they are to be located. The book has left us with the impression that the success of some well-known British and American enterprises is due in no small measure to the employment of industrial designers. Wedgewood was a pioneer in this direction. We seem to see a little inconsistency in the author's outlook on environment. At one place he points to the futility of employing an architect to embellish a badly designed house. Elsewhere he illustrates a radio set resembling a power station control instrument without saying that it would blend harmoniously with the fittings of an American bar and be an eye-sore in the average suburban home. Again, he commends the production of an electric fire using anodised aluminium in the form of a globe. Here, again, the tacit assumption is that our future homes are to be like flash night clubs.

The industrial designer must realise that the bulk of the discriminating population has to take into consideration his existing property when making new purchases. In the kitchen and bathroom the modern housewife is prepared to scrap everything until a maximum of utility and hygiene has been achieved, but not so in other rooms. The author has evaded the question as to how the small manufacturer can be helped in the improvement of his designs, for he cannot avail himself of the services of an industrial designer. But this is only in line with every modern development, as all seem to us to favour the large concerns. Finally, we have given this book such prominent notice, because we believe it should be read by foundry executives whose products reach the "woman in the street."

The last chapter sets out the author's views on the ironfoundry industry. In it he stresses its past deficiencies and his hopes for its future resuscitation.

* "The Missing Technician in Industrial Production" by John G. Coag. Published by George Allen and Unwin, Ltd., 40, Museum Street, London, W.C. 1. Price 7s. 6d.

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SPOT TEST FOR LOW CHROMIUM

Mr. R. H. Williams, writing in "Metal Progress," states that McKinnon Industries, Limited, of St. Catharines, Ontario, tests all incoming steel scrap destined for malleable iron manufacture. The spot test does the job in less than 5 min.; laboratory analysis may later check the preliminaries. However, once the tester becomes adept he can judge results from 0.2 to 0.10 per cent. chromium to within 0.02 per cent.

It is necessary to run a blank for reagents. Solution No. 5 should be mixed fresh every day, as it develops colour on standing. As the original article pointed out, standardisation of procedure is also of utmost importance.

Solutions required.—No. 1. Water 400 ml., NaOH 20 g., bromine 2.5 ml. (Caution: Handle bromine solution under a hood and wear rubber gloves when mixing) g. No. 2. Water 250 ml., conc. HNO_3 200 ml., 85 per cent. phosphoric acid 50 ml. No. 3. Water 25 ml., conc. H_2SO_4 5 ml. No. 4. Carbolic acid crystals 5 g., acetic acid 50 ml. No. 5. S-diphenyl carbazide 100 g., acetic acid 5 ml., ethyl alcohol 50 ml.

Procedure

(1). Clean surface spot of steel by filing or grinding. (2) Place a drop of dissolving acid (Solution No. 2) on cleaned steel and allow to stand for 30 sec. (Time is important.) (3) Touch the flat end of a stirring rod to the steel and place drop on heavy filter paper or spot test paper, where there is already a drop of Solution No. 1. (4) Move rod thoroughly until the brown is evenly distributed. (5) Add one drop of Solution No. 3 and move rod around spot until brown solution dissolves. (6) Add one drop of No. 4, stir slightly. (7) Add one drop of No. 5; and (8) A faint pink or violet colour of increasing intensity indicates low chromium. From 0.10 to 0.20 per cent. and higher often give black spots with deep violet rings. These can be checked against results for steels of known analysis.

INDUSTRIAL FUTURE OF THE NORTH-EAST

Concerned for the industrial welfare of the North-East after the war, an influential group of industrialists and M.P.s have issued a memorandum on the area's post-war prospects. It is stressed that the industrial position of the North-East is much the same as before the war. There is a danger that unless preventive steps are taken, there will be a substantial number of workers for whom employment cannot be found. The transfer of workpeople from the North-East to industries in other parts of the country is wasteful, the memorandum declares, and it recommends that the Government should take a greater interest in the planning of new industries. Work should be brought to the North-East and the Government should take more definite action in this direction. The memorandum adds that light engineering trades and synthetic industries making products for home and export are needed.

PISTON CROWN TEMPERATURES IN A COMPRESSION IGNITION ENGINE

Mr. W. L. Bride, in a Paper published by the Institution of Mechanical Engineers covering the above subject, has drawn the following conclusions:—The most striking feature of the results obtained is the rapid rise of the piston temperature with increasing load, when compared with other engines. In particular, when comparison is made with the Mirrlees-Ricardo sleeve valve engine (1937), the temperature of the Dorman piston is 100 deg. C. higher than that of the Mirrlees at 70 lbs. per sq. in. brake mean effective pressure, the difference decreasing with reduced load. It has been shown that the higher temperatures of the Dorman piston are due to the combustion induced turbulence which not only rapidly increases with load, but becomes more widespread over the piston crown. That increased gas turbulence has a considerable effect on rate of heat transfer is well known, being usefully employed in certain modern boilers such as the "Velox."

With variations in speed and cylinder liner temperature the effects on piston temperature are of the same nature as those observed in previous work, both demonstrating qualitatively the important part played by the circulating oil and air in the crankcase, in dissipating the heat from the piston. The latter variation is interesting in view of its support of the use of higher cylinder liner temperatures, a tendency which has gained increasing favour from other considerations.

Published data show that the strength of "Y" alloy remains practically constant between temperatures of 200 deg. C. and 300 deg. C., being about 17 tons per sq. in., a reduction of 19 per cent. below the strength at normal temperatures. At 350 deg. C. the strength is reduced to 12.1 tons per sq. in., so that unless such a temperature is reached, there is little fear of structural failure of a well-designed piston.

Foundry Engineering Lectures.—A course of lectures on "The Fundamentals of Foundry Engineering" is being given at the Stevens Institute of Technology, Hoboken, N.J., to help meet the expanding and diversified demands upon foundry engineering. The lectures have been arranged in co-operation with the Educational Committee of the American Foundrymen's Association and the U.S. Office of Education.

Potash Bath for Electro-tinning

With a definite trend towards heavier coatings in electro-tinning steel strip, superiority of the potassium stannate solution over the conventional sodium stannate bath has been amply demonstrated, according to Frederick A. Lowenheim, research chemist, Metal & Thermit Corp., Rahway, N.J. While the cathode current densities obtainable with good efficiency have been lowered somewhat, they still represent increases over those obtainable with the soda bath of from 100 to 500 per cent.—"Steel."

QUALITY CONTROL IN HIGH DUTY IRON PRODUCTION*

Importance of ensuring constancy in casting performance

By E. W. HARDING
(The International Meehanite Metal Company, Limited)

Control of product quality is the aim of all industrial production, and this applies to the foundry as much as to any other industry. It is, in fact, more important to the foundry because lack of product uniformity has always been the greatest obstacle to the advancement of the industry, certainly as far as cast iron is concerned. Technical research is applied increasingly to raise the standard of casting performance, but the less interesting, though far more important, work of ensuring constancy in this performance tends to be neglected. The fact is that the primary need in the foundry to-day is not so much new metallurgical discoveries as the application of existing technical knowledge to control operations and casting properties within narrow limits.

It will be well at the outset to be quite clear as to what is meant by controlling the quality of a product. The word quality has two meanings. Used subjectively it has reference to the goodness of a thing, particularly in relation to human wants. In this sense it is practically synonymous with grade—high quality implying high grade or performance. This is the meaning commonly applied to the word. In the objective sense, however, quality is related to the nature of a thing; that is, the properties or characteristics which make a thing what it is and distinguish it from other things. The Paper is concerned with this meaning, in which quality is measured, not by how good or useful a product is, but by the characteristics of the material in relation to desired or standard characteristics. Consequently, when reference is made to controlling the quality of a product, the consistent maintenance of properties to definite standards is meant, without reference to the level of those standards. It will be evident, however, that absolute uniformity is impossible of attainment, and therefore quality is a relative term to be expressed as far as possible quantitatively. A numerical measure of quality is, in fact, a necessary condition in setting quality standards.

In dealing with quality control in the foundry, consideration will be confined for the present to metallurgical control. For one thing, it is the logical starting point in foundry control, since metal quality is the foundation of good castings. It also lends itself more readily to treatment on statistical lines and the technique developed for controlling metal quality can eventually be applied to other factors in casting production, such as defectives control, sand control, etc., as experience is gained with the system. Although specific mention is made of high duty iron control, the system to be described may naturally be applied to foundry metallurgical control in general, regardless of the metal produced.

Quality Standards

The setting of standards of quality is a necessary preliminary to quality control. This ultimately means determining the limits within which property values may lie and yet conform to quality requirements. There is nothing absolute about these limits and the extent of the permissible variation from the central value will depend upon a number of factors, the predominating one being economic. When quality standards are applied to metal control, the following points arise:—

(1). For each type of metal produced there is an acceptable range of properties, within the limits of which quality demands are satisfied.

(2). The standard of quality attained in production for a particular type of metal will be assessed on the variation of the values for the essential characteristics from the central desired value.

(3). The metal properties to be used as the basis for assessing quality must be determined.

(4). The magnitude of the value for each of these properties and the maximum permissible variation from these values must be established.

Metal Properties as Quality Characteristics

Of the properties possessed by metals, only those fulfilling certain practical conditions may be used with advantage in Quality Control. Two essential conditions are:—

(1). They should be closely related to the service demands for the material (Purchaser requirement); and

(2). They should be susceptible to easy and accurate measurement (Manufacturer requirement).

These conditions obviously restrict the available properties. The primary characteristics will be the physical properties, particularly those used by the designing engineer—tensile, compression, modulus of elasticity, fatigue, etc. However, not all these fulfill the condition of facility of routine measurement. For high duty iron the test that has proved of greatest value in meeting both the above conditions is that of tensile strength.

In addition to these primary characteristics, there are others that may be termed secondary in that, though not of fundamental significance, they are useful guides to metal uniformity. These consist of test values for chemical composition and such routine physical tests as transverse, deflection, hardness, which possess the great advantage of meeting the requirement of easy measurement. For the quality control of Meehanite

* A Paper read before the London Branch of the Institute of British Foundrymen, Mr. H. W. Lockwood presiding.

Quality Control

Metal, the test values which are applied as representing quality characteristics consist normally of tens.le strength, and carbon and silicon contents.

Magnitude and Permissible Variation for Quality Characteristics

This study is not concerned with quality as related to any particular set of values for these properties. The magnitude of the quality characteristic has no fundamental importance; its selection is governed mainly by expediency, but, once established, it forms the basis for assessing standards of control. The permissible variation from these standard values for quality characteristics is a different matter. The principal factor here is economic. In general the narrower the range to which the results are held, the higher will be the cost of production. The setting of tolerances for Meehanite test values follows closely general engineering practice, in establishing a balance between what can conveniently and economically be obtained by the producer and what is required by the purchaser.

The question of control limits will be considered in more detail later, but two types of limits must be recognised at this point:—

(1) *Specification Limits.*—These are arbitrarily set values outside which it is declared the loss of value is such that the product is rendered unserviceable or uneconomical in use. They are essentially a purchaser control.

(2) *Control Limits.*—These are production limits used as the basis for judging product uniformity from lot to lot or period to period. They indicate the state of control at any given time.

To satisfy both purchaser and producer requirements the control limits should fall within the specification limits, and the narrower the control range in relation to the specified range the higher the standard of control and quality of product. Also the greater the factor of safety in casting production, with reduced defectives and increased customer confidence.

Measurement of Control

In high-duty iron production, certain kev control points should be established. These include:—(1) Control over raw materials; (2) control over charging practice, including charge composition, weighing, etc.; (3) ladle control—alloy additions, etc., and (4) control over combustion conditions—coke quality, blast volume and velocity, bed height, etc. These controls are the protection of the foundry against melting and metal fluctuations. Supervision is concentrated at these points and, by using control instruments where possible, variations due to the human element are reduced to the minimum. In general, every effort is made to obtain standardised practice from day to day with the object of securing the highest degree of metal uniformity attainable.

These controls give a vast improvement in metal uniformity, but this does not mean that a consistently high degree of metal uniformity is necessarily obtained. In actual fact, it is known that this is not so, and that wide differences exist between different foundries and for different periods in the same foundry. It all depends on how these controls are applied in practice. The first step, therefore, in establishing quality control is to find some measure of the degree of metallurgical control in operation.

The normal way of estimating the standard of control in a foundry has been to judge the extent to which these key controls are applied in practice. Such a method, however, can never produce the final answer, because it is too dependent upon personal judgment and lacks a quantitative basis. A better way is to examine, not the *operating practice*, but the *result*. That is to say, instead of judging the standard of control by the degree of application of the various key controls, it is assessed on the values obtained for the final product (as indicated by chemical and physical testing) in relation to standard values. This at once places the system on a quantitative basis, and gives a fresh outlook on the control problem.

It has been evident for a long time that not enough use was being made of test results. Obviously, if these could be treated on a suitable basis they would form the best indication of metal uniformity and therefore of operating control. In other words, if the results are right, then the production method must also be right. If the results are not satisfactory, then the methods must be investigated and corrected.

This, however, depended upon a suitable treatment of test values, and it was not until treatment on statistical lines was applied that the system became practicable. This system uses the known properties of the frequency distribution curve for defining the essential characteristics of the product. There is nothing complicated or highly mathematical about this method, and while it is new to the foundry industry, it has already been applied in engineering shops for quality control purposes. The whole basis of statistical treatment is the frequency distribution, and this plays so important a part in the system that a brief review of its essential features will be advisable.

Any set of data derived from a constant system of causes, and where a large number of small causes operate, gives a frequency distribution having certain definite properties. An example of such a distribution would be the sequences of heads or tails occurring on tossing a given number of coins for a large number of times. Here there is a distribution resulting from the influence of many chance causes, and it is found that there is a constant relation between the occurrences of the various sequences. That is, there is a certain number of sequences which occurs most frequently, and the further a number is from that average value the less frequently does it occur. If the value of these sequences is plotted against their frequency of occurrence, a curve approximating more or less closely to what is known as the Normal Distribution curve is obtained. The greater the number of items in such a distribution the closer is the approach to the ideal curve.

Now, if this principle is applied to the treatment of a large number of test values, a similar curve will be obtained. That is, if the test values are grouped into classes according to the magnitude of the value, it will be found that the number of items, or frequency, will be small for the classes of low magnitude, increasing for the medium value classes, and finally decreasing again as the highest values are reached. In other words, small deviations from the average occur frequently, and large ones relatively infrequently. For the purpose of illustrating the types of distribution obtained in practice, examples are given in Table I of actual tensile test values from two different foundries for Meehanite Type "GC."

It is worth noting that even without any further treatment such an arrangement of test data is useful in a number of ways:—

(1). It gives a clearer indication of the relative values obtained by a foundry than was apparent from the original records.

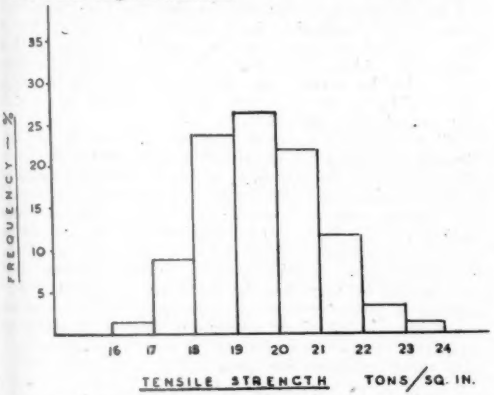

FIG. 1.—FREQUENCY DISTRIBUTION OF TENSILE VALUES FOR FOUNDRY NO. 1.

TABLE I.—*Frequency Distributions for Tensile Values.*

Class. Tons per sq. in.	Frequency, per cent.		Relative frequency, per cent.	
	Foundry. No. 1.	No. 2.	Foundry. No. 1.	No. 2.
16.0 to 16.9 ..	3	—	1.4	—
17.0 to 17.9 ..	18	—	8.6	—
18.0 to 18.9 ..	50	11	24.0	5.3
19.0 to 19.9 ..	55	53	26.3	25.5
20.0 to 20.9 ..	47	77	22.5	37.0
21.0 to 21.9 ..	26	47	12.5	22.6
22.0 to 22.9 ..	7	15	3.3	7.2
23.0 to 23.9 ..	3	5	1.4	2.4

(2). It permits easier comparison between the results for different foundries or different periods for the same foundry.

(3). It indicates the approximate position of the central value.

(4). It provides a general idea of the spread of results.

The frequency table may be represented graphically in the frequency diagram or histogram as an aid in visualising the relative values and variations. This is shown by Fig. 1 for the tensile values for Foundry No. 1 of Table I.

An alternative method of presentation is the frequency curve which shows even more clearly the extent of the values and variations. This is shown in Fig. 2.

These distribution curves have two primary characteristics:—

(1). The relative position on the scale of measurement; in particular, the magnitude of the central value, and

(2). The dispersion of the items about this central value.

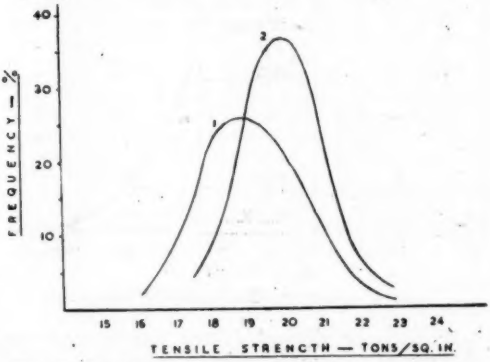

FIG. 2.—FREQUENCY DISTRIBUTION CURVES FOR TENSILE VALUES.

These two characteristics are essential in defining a distribution. The measure employed in control work for describing the central value is the Arithmetic Average; while that in normal use for expressing the dispersion of values about the Average is the Standard Deviation—that is, the root-mean-square deviation of the numbers from their average. Knowing the Average and Standard Deviation of a normal distribution, the frequency with which the various values will occur can be calculated. That is, there is a definite relation between the standard deviation and the proportion of items occurring for any given distance on either side of the Average. For example, the range of plus and minus 0.67 times the Standard Deviation includes 50 per cent. of the total items; while plus and minus three times the Standard Deviation includes 99.7 per cent. of the whole distribution. It is thus possible

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to predict from a knowledge of the Average and Standard Deviation what proportions of the total items will lie within any definite range on the scale of measurement. This is shown graphically in Fig. 3.

What this really means, as applied to metallurgical control, is that by determining the Average and Standard Deviation of a number of test results coming from the same source, we can tell *in advance* the limits within which any given proportion will lie. That is the essential principle used in control chart work, to be described later.

Two conditions apply in setting control limits within which a known proportion of the test values will lie:—

(1). The distribution should be normal. This applies mainly to precise determinations of

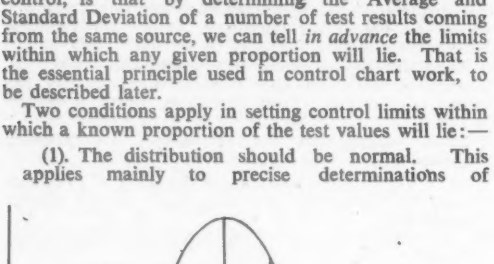

FIG. 3.—NORMAL DISTRIBUTION CURVE.

probability of occurrence. For control work, an extreme of accuracy is seldom required, and even if the distribution is slightly out of normal (*e.g.*, skewed), the probabilities associated with the various values for standard deviation are sufficiently accurate for practical work.

(2). The system under examination must be in a state of control. The expression "state of control" is used here in the statistical sense, in which a process is said to be controlled when, through past experience, we can predict the limits within which the product will vary in the future. Where control is absent, no such prediction can be made.

The second condition is used as a criterion of the state of control. That is to say, the assumption is made that a state of control does exist and control limits are established on this basis. If, then, it is subsequently found, for example, in metallurgical control work, that the test values fall outside these limits to a greater extent than is to be expected from the probability associated with the limits, the conclusion is reached that control has broken down and that an assignable cause of trouble is present.

There are two types of variation which occur in all production processes:—

(1). Those due to a large number of minor causes, none of which singly exerts a significant influence.

(2). Significant variations due to a assignable cause of trouble.

Variations of the first type are those normally associated with the process. In the case of metallurgical control, there are variations which are inherent in the process—variations in raw material composition, errors in charge weighing, slight differences in charging practice, variable blast volume and velocity, and the many other possible sources of variation. These causes are present all the time and the sum total of the variations they produce will vary from foundry to foundry. However, by taking a large number of test results and calculating their Average and Standard Deviation one should find that the variations inherent in the process and operating conditions for any one foundry would all be contained within certain limits. The range for these limits would then be a quantitative evaluation of the standard of metallurgical control existing in that foundry. Also, provided no fundamental change occurs in the process or operating conditions these limits will continue to represent the standard of control for an indefinite period.

If, however, a definite change did occur at any time in the process, such that the frequency curve was disturbed and the Average or Standard Deviation, or both, altered, then the original control limits would not contain the test results, and this would at once indicate that a variation of Type 2 (*i.e.*, an assignable cause) was present. That is briefly the relation of the frequency curve to the Quality Control Charts. It can readily be seen that the limits on the curve, representing a given proportion of results, correspond to the limits on the chart. Before dealing with the construction of the control chart, it will be advisable to give some consideration to sampling procedure.

Sampling Procedure

The object of sampling is to obtain an estimate of the characteristics of the bulk and the sampling procedure to be adopted, for a reliable estimate must depend upon the nature of the material. In the case of a heterogeneous material, such as a consignment of pig-iron, it is evident that the accuracy of the estimate is related to the sample size. The greater the number of pieces taken, the more nearly the true Average and Standard Deviation of the bulk is approached. However, sample size is limited in practice by economic considerations, so that the estimate of bulk characteristics must be based on a sample size which is a compromise between what is desired for an accurate estimate and what is convenient and economical in testing practice.

In the case of a relatively homogeneous material like molten cast iron, however, the case is obviously different. Here, one individual test may supply, not merely an estimate, but the actual properties (within

the limits of testing error) of the bulk of metal represented, so that, if all the molten metal produced in one day could be transferred to one container, then a single test would be sufficient. Under normal conditions, however, the melt is tapped into a number of ladles, varying from a few to a very large number. Since it is rarely practicable to test every ladle of metal tapped, the characteristics for the product as a whole must be estimated from the sample average and standard deviation for the ladles tested over a given period, due allowance being made for sample size. Two considerations are thus involved in determining suitable sampling procedure:—(1) The proportion of ladles which should be tested to provide a reasonably accurate estimate of product characteristics, and (2) the period of time, or bulk of product, to be taken as the basis on which the estimate of product characteristics is to be made.

The proportion of ladles tested varies normally for cupola melting from 1 in 10 to 1 in 5. An alternative expression for sampling procedure, which would be more satisfactory in the case of cupola melting, is to sample for each hour of melting. By relating sampling to both tonnage and time, it permits more reliable comparison between melting control on cupolas of widely different melting rates.

Size of Sample

The second question is largely statistical in nature, and relates to the sample size best suited to the particular control problem. The term sample here refers to the group of test specimens representing the product. In general, it is desirable in metallurgical control work that the bulk selected should represent neither too long nor too short a period of operation. For example, the period should not be so long as to postpone completion of the sample beyond a reasonable time (say, one week's working); nor so short that the sample size is unduly small (below 4), where the product is split up into unnecessarily fine sub-divisions. A further point is that the sample should preferably lie between 4 and 10 items to avoid loss of accuracy in using the Range in place of the Standard Deviation. From these considerations, a sample of six items is used in Meehanite control work, and this is found to work out satisfactorily in regard to the period of time represented. This does not mean that one should try to keep the sample to exactly one working week's output. There is no fundamental relation with any fixed period of time. For example, a sample of six items may take two days for one foundry to complete and eight days for another foundry. An essential requirement in grouping test specimens is that each group should represent common conditions, producing constant causes of variation. In metallurgical work, the primary sub-division is by type metal and by time. Other bases for grouping could be employed, for example, separating the results for each furnace, but this would normally be needed only in searching for assignable causes of variation.

One other point of great importance in forming an estimate of product characteristics is that

(*Continued at foot of next column.*)

DETERMINATION OF Mo AND W BY SPECTRUM ANALYSIS

A method for the determination of low contents of molybdenum and tungsten in ores by spectrum analysis is described by C. GEORG CARLSSON ("Jernkontorets Annaler," 1943, p. 581). The finely pulverised sample to which certain admixtures have been added is placed in a recessed copper bar, which is employed as one of the electrodes in a direct-current arc.

The accuracy of the method has been checked by chemical analysis carried out by several laboratories. The results obtained on both ore samples and more particularly on synthetic samples with varying base compositions have shown that the method for spectrum analysis is accurate to ± 0.01 per cent. for contents below 0.25 per cent., whereas the accuracy for chemical determination was found by the author in an earlier investigation (JKA 125, 1941, p. 697/704) to have been only ± 0.02 per cent.

Chemical analysis requires a skilled analyst, whilst the spectrum analysis can be carried out as a matter of routine by a laboratory assistant. The time required for the spectrum analysis is estimated at 1 hr. for one sample, and 30 min. for each additional sample. To this time must be added time lost while the plate is fixed, washed and dried, estimated at 2 hrs. In case of rapid analyses being required it is possible to reduce the time needed for the development and further treatment of the plate; according to previous statements it has been possible to reduce this time to as little as 5 to 10 min.

The sensitivity of the method is considered sufficient for practical purposes; MoS_2 can without difficulty be determined in concentrations down to 0.005 per cent. and WO_3 down to 0.01 per cent.

A South African Development

Eclipse Tube Mill Liners ((Pty.), Limited, have been successful in starting the manufacture of chilled iron shot and grit. The large sizes of shot are used as gig beds in base and precious metal ore dressing. The selling agents are Bellamy & Lambie, of Johannesburg.

(*Continued from previous column.*)

sampling and testing practice must be controlled. In particular, it is necessary to form some estimate of errors of measurement so that one may determine to what extent the variation in test values is due, not to metal condition, but to errors in sampling and testing procedure. It may be thought that this is a matter of small importance, and few foundries trouble to check the point, but in a number of cases where it has been examined the results have been revealing. An example of the possible variation due to testing technique alone is given in Table II in a series of tests carried out on tensile test-bars. The procedure and results will be briefly described.

(*To be continued.*)

FOUNDRY WORK AT CAPE TOWN

Gearings (1878), Limited, of Cape Town, the oldest and largest South African firm of marine engineers and shiprepairers, have made a very large contribution to the Union's work of keeping the Allied merchant fleets at sea.

This wartime work has necessitated the tackling of many jobs, which in peacetime would have been sent to Europe. Among such jobs has been the making of a cylinder and valve chest complete, weighing more than 11 tons and representing the heaviest job of its kind in this country's engineering history.

Another big job was the making of a 2½-ton Diesel cylinder line, which was cast, machined and fitted. Several big centrifugal pump casings have been made, as has a 10-ton flywheel. Rudders have been made for 10,000-ton ships. One 9-ton rudder was made in five days!

The firm have undertaken the complete rebuilding of the stern of a 10,000-ton ship, fitting new rudder posts, new rudder, new tail-end shaft, and new propeller, all this work, moreover, being carried out on a floating pontoon, for the size and length of the job made it undesirable to have the graving dock monopolised by one ship for so long.

Complete new bows have been built on a number of vessels which had been damaged in collision or by enemy action. These vessels ranged up to 18,000 tonners, so that it is clear that the building of large ships is not beyond the Union's powers, though whether it would be economic is another matter. The firm have also carried out the big job of converting a passenger liner into an armed merchant cruiser, complete with offensive armament. They have also undertaken the entire refitting of an armed merchant cruiser which had been damaged in an engagement.

An unusual job was the straightening out of the 12-ton bronze propeller of a 10,000-ton ship by putting it under a 200-ton press. This particular job had never before been tackled in this country, and its successful completion put another ship to sea, for there was no spare propeller available, and one could not have been made in the Union.

One branch of these non-marine activities is, however, well worth mentioning. For 40 years the firm have made the famous "Gearing Windmill," which is to be found in all parts of Southern Africa. Earlier this year Gearing's established a new factory devoted solely to the making of windmills. All materials for this factory were made in South Africa, existing machinery being adapted for the purpose, and production is now approaching the target figure.

CATALOGUE RECEIVED

Portable Electrical Apparatus. A leaflet received from the British Central Electrical Company, Limited, of 6 to 8, Rosebery Avenue, London, E.C.1, describes and illustrates a continuity tester for detecting the faulty earthing of cables; a break locator, and vulcanizer for repairing cables.

AMERICAN ALUMINIUM FOUNDRIES

The War Production Board, seeking to correct the trend by which primary aluminium producers in America are overburdened by orders, while secondary ingots are backing up at the smelters, has notified foundries and die-casting plants to challenge any orders they receive specifying the use of primary metal, reports "Iron Age." The claimant agencies, W.P.B. said, rarely specify use of primary metal when issuing contracts. Instead a performance standard for the ultimate end product is usually specified, and in most instances this could be attained with metal produced by secondary smelters.

The responsibility for the situation rests, according to the Board, either with the foundries, which may be ordering a higher grade of metal than is necessary because of easier handling, or with unnecessarily stringent standards being set by consumers. The situation has developed since the change in operation procedure under C.M.P., whereby foundries are licensed to purchase ingots without submitting their individual orders to W.P.B. for analysis. The situation, W.P.B. says, is daily becoming more aggravated.

Besides asking foundries to scrutinise orders for primary metal specification, and to report data on such orders to the castings section of the Aluminium and Magnesium Division, W.P.B. has invited foundries already using a large proportion of secondary alloys to build up their inventories of this material to a 60-day supply, instead of the normal 30-day inventory.

Aluminium Castings Output

Production of high-strength heat-treated aluminium castings has doubled during the past 18 months in America; pointing out at the same time, non-heat-treated sand castings, the principal peacetime type, have remained at the same production level. Since the start of the war, the use of dense castings made on high-pressure cold-chamber machines for aircraft and ordnance uses has grown to the point where these constitute over 80 per cent. of total deliveries.

Total deliveries of castings during 1942 were 162,000 tons, according to the W.P.B. Gravity die castings delivered in 1942 amounted to 30,000 tons, and die castings 28,000 tons.

Briquetting Cast-iron Turnings

L. F. SNITZER, according to the Russian "Foundry Journal," has investigated the melting properties of briquettes made from cast-iron turnings. In one series of tests, three charges were prepared, the first without briquettes, and two with 21 and 28 per cent. briquettes respectively. Total melting losses were 3.9 per cent., 4.1 and 5.1 per cent. respectively, while the slag yields were 8.4, 9.0 and 13.0 per cent. respectively. The output of the furnace was fairly constant between 0.75 to 0.80 ton per hr. Better irons were obtained from the charges containing the briquettes, the transverse strength of charge 2 being 28 per cent. higher than that of iron from charge 1, while the improvement in charge 3 against charge 1 was 31 per cent.

LONDON BRONZE FOUNDERS WANT STANDARDISED TEST-BARS

The discussion on Mr. W. A. Baker's paper reveals urgent need for action

Following the presentation of Mr. W. A. Baker's Paper on "Test-Bars for Bronze Castings," which was printed in our issue of February 24, an animated discussion on all aspects of the question revealed a general desire that new standards should be prepared following closely the precepts and designs* advocated by the Canadian Non-Ferrous Castings Committee.

The chair during the discussion was occupied by Mr. Frank Hudson, as the Branch-President had to leave the meeting early.

Speaking as one of the original members of the Institute's Non-Ferrous Metals Sub-Committee, who had helped to draw up the specification for the standard I.B.F. test-bars a few years ago, the CHAIRMAN confirmed Mr. Baker's remarks that to some extent that bar was not altogether satisfactory. There was no doubt, he said, that a certain amount of porosity occurred towards one end of the test-bar, which very often caused the bar to break at the shoulder.

The Canadians had rather beaten us to the post with regard to the standardisation of non-ferrous test-bars, for a Report had been issued recently on the subject by the Castings Advisory Committee in Ottawa, representing all the Service Departments in Canada. That report had just reached this country.

The Report recommended two forms of test-bar, both of the Keel type. Non-ferrous foundrymen in this country would no doubt like the opportunity to consider and perhaps to criticise the Canadian report; it might help a great deal if it could be accepted here.

Where the I.B.F. Bar Fails

MR. G. T. CALLIS commented that rather a preponderance of Mr. Baker's results related to de-gassed metal, whereas it was not the common practice to use completely de-gassed metal in the non-ferrous alloy foundries. Indeed, it was virtually impossible to secure, under foundry conditions, that there was not a certain amount of gas in the metal. However, Mr. Baker had himself commented that the objects of his research were somewhat at variance with those of the foundryman.

An extremely important point to be borne in mind was that whoever was concerned with the making of test-bars should really learn how to make them; and the I.B.F. bar served to emphasise that point. It was not possible to achieve the best results, in the small I.B.F. bar, by pouring the metal in at one end because, as Mr. Baker had said, the heat centre of the bar was not at the middle; it was necessary to add the last of the metal at the riser, which was not the end from which the bar was poured.

In the last set of results shown by Mr. Baker the results for the D.T.D. bar were consistently better than those for the Keel bar when the metal was de-gassed; but the reverse was the case where the metal was slightly gassed.

A particular objection to the Stargate bar was that when running dirty metal—as in the case of some of the highly leaded gunmetal, and particularly some of the cupro-nickel type of alloys—from both ends, although there was freezing control in the right directions, from the centre outwards, at the same time, unfortunately, all the dross which went into the mould was trapped in the middle of the test-bar.

Finally, discussing what the foundryman expected to get from a test-bar, Mr. Callis said that he wanted the best results possible showing that his control of the metal in the foundry was satisfactory. If, however, he wished to make an attempt to produce a test-bar to give mechanical properties which might be expected in some parts of the casting, it would then need to bear some relation in section to that of the casting it represented, particularly if note were to be taken of such factors as gas content.

MR. BAKER agreed with many of the points raised by Mr. Callis. With regard to the I.B.F. bar and the necessity for pouring some metal into the gate and topping up the riser, he said that one had often to adopt that practice in making an actual casting, but he did not feel that it was a practice which could easily be standardised. One man might put in twice as much metal as another and obtain a different result. There was bound to be a certain measure of skill involved in the making of a test-bar, but any standard form of bar adopted should be as foolproof as possible, and the method of pouring the I.B.F. bar in particular did not appear to him to be very foolproof.

While he agreed that in the making of the Stargate bar there was some danger of trapping dross, he was not sure that that danger was quite so great as Mr. Callis had suggested, because the Americans used virtually that form of bar for aluminium alloys, and one would expect the danger of trapping dross to be at least as great in aluminium alloys as in some of the bronzes. He illustrated the Stargate bar and the method of gating, and said that if there were serious danger of trapping dross one would expect it to occur in the light-alloy bar, but apparently the Americans were successful. Further, he believed that a number of people in this country were using that bar successfully for tin bronzes.

It was true that most of the figures given in the Paper referred to de-gassed bronzes; he agreed that the metal used in practice was probably not com-

* See our issue of January 27, 1944.

Standardised Test-Bars

pletely de-gassed, and said that in many cases one did not want it so. But it seemed to him that one should not try to design a test-bar which would give figures to meet some arbitrarily defined specification limits, and in so doing to obscure the effect of the gas. It was more rational to accept the figures given by the test-bar and to specify accordingly.

With regard to the recommendations of the Metals Control in Ottawa, Mr. Baker illustrated the two forms of Keel bar (Figs. 1 and 2, and the Canadian Report) advocated for non-ferrous metals—manganese bronze, aluminium bronze, silicon bronze, and so on.

For tin bronzes, the Control advocated one of two forms (Figs. 3 and 4) of Keel bar. A number of criticisms could be made of these bars. Mr. Baker criticised them from the point of view that the feeder was particularly thin and very deep. The cross section was about 1 in. and the depth 4 in.; he suggested that the feeder would be equally effective if about 1½ in. were cropped off, for he was sure that that 1½ in. did not add very much to the effectiveness of the feeder. The feeder would be much better if it were more shallow and thicker. In trying to evolve a form of test-bar which would be generally acceptable, he had considered the various forms advocated and in use, and had arrived at the form shown in Fig. 9 of the Paper.

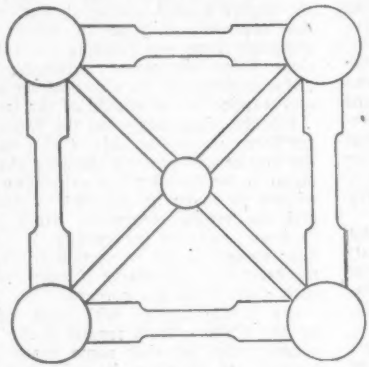

FIG. A.

The two cylindrical bars were so arranged that one could conveniently insert a saw and slit them off afterwards. The metal was poured through necks ¼ in. thick at the ends, feeding into a 1-in. bar. The bar was 6½ in. long and the necks extended 1¼ in. from either end, so that only 3 in. in the middle of the length was unfed.

Whereas in the case of the Crown and Webbert bars the weight of material used to produce a single bar was about 10 lbs., in his suggested method the weight was only about 6 lbs. for two bars. The form of bar he had suggested had not yet been tried, so that he could not say definitely that it would be successful. But, from a consideration of other forms which had been used, and bearing in mind one's own experience, he would expect to find such a bar to be quite satisfactory. However, he would like to hear opinions about it.

A Modified I.B.F. Bar

MR. DUNLOP, confirming the weakness of the I.B.F. pattern, said that some years ago, in connection with the work which the I.B.F. was sponsoring for leaded bronzes, he had cast a number of test-pieces in leaded bronze to that pattern. Of 26 bars which were cast by pouring all the metal in at one end, seven (about 25 per cent.) had broken on test at the riser end of the parallel portions. The scattering of the plotted results was quite considerable. Subsequently a few tests were made with a view to overcoming that difficulty, and it was found that it helped materially if one could pour the metal simultaneously from both ends. One must not interrupt the pouring, but there should be an ingate coming in to the end of each riser, in a

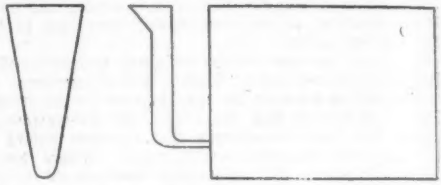

FIG. B.

FIG. C.

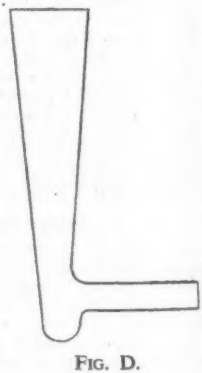

FIG. D.

manner similar to that adopted in casting the star-shaped bar which Mr. Baker had illustrated, with the difference that Mr. Dunlop retained the reduction of cross-section at the centre. One of his standard bars was made in that way.

Illustrating by Fig. A the general arrangement, in plan, he said that four bars were produced at the same time. The dimensions of the bars were exactly as in the I.B.F. standard pattern, but the feeder was thickened a little.

That type of casting, used for the general run of bronzes, gave very consistent results as between one bar and another in the set of four, which was very important. Particularly where one had to cast, say,

three bars in order to meet the requirements of an inspecting authority, it was necessary to be able to ensure that all the bars were of the same quality.

Next, Mr. Dunlop illustrated in Fig. B a type of bar which was suitable for high-shrinkage or drossy alloys such as manganese bronze or aluminium bronze, though he did not suggest that it was suitable for all types of non-ferrous alloys. He indicated the position of the downgate, and said that one could cast four or five bars at the same time. That bar also gave good and consistent results in high-shrinkage alloys such as Monel and the high-nickel alloys generally.

Next, he showed by Fig. C an end view of the arrangements for casting another type of bar, using a thickened feeder. That type of bar, he believed, was advocated by Hoost, the Canadian, when the I.B.F. reports on the leaded bronzes were under discussion. Three bars of equal quality could be produced by that method. When using that type of bar for some nickel silver alloys, however, Mr. Dunlop had found that often there was quite a lot of shrinkage, which could extend into the bar; it was much safer, in those alloys, to be content with one bar per casting than to try to produce three.

For Monel metal he had tried the cruciform section bar, which was put forward for steel by C. H. Kain, of the London Branch of the I.B.F. One obtained three bars, with a riser on top. One big disadvantage of using that method, however, was the difficulty of cutting off the test-pieces. Although Kain had said that he flame-cut his steel bars off the block, it was a different matter to try to cut off Monel bars when cast in that way. In Mr. Dunlop's experience, the type of bar he had illustrated previously for Monel gave better results.

MR. BAKER commented that the various illustrations given by Mr. Dunlop exemplified the point made in the Paper, that there was scarcely a limit to the shape and size of non-ferrous test-bars. A matter which some people had found to be very important, particularly in the case of bronzes, was the weight of metal cast per test-bar. Some test-bars might require 10 or 15 lbs. of metal; that seemed to be a disproportionately large amount if there were only 150 lbs. in the pot. In the single Keel type bar, for example, the weight of metal used per specimen was quite large.

It was worth noting that the Ottawa Report strongly advised that cast-on test-bars should be abolished. In the introduction to the Report, the Castings Advisory Committee had put forward its views as to the use of test-bars, stating that they were not intended to give tensile values representing the properties of the castings, but that they were intended merely as inspection tools, to ensure that the quality of the metal was right.

He believed that that view was slowly gaining acceptance in this country; in his knowledge, cast-on test-bars were not very often advocated. In that connection, it seemed that if any action could be taken through the I.B.F. in the direction of standardising test-bars it could be stated without any hesitation that cast-on test-bars should be abolished. He did not think that many of the members would advocate them.

MR. WILLIAMS, responding to the Chairman's invitation to the meeting to comment on the shape of the Keel bar advocated in the Ottawa Report, said that the Keel bar was quite good for manganese bronzes, but not for the phosphor bronzes or gunmetal. For the two latter it was necessary to use pressure, and he illustrated by Fig. D the longer tapered form of bar, of which he had had a good deal of experience.

The width at the top was about 3¼ in., tapering to 1 in. at the bottom in a length of about 11 in. The bar was run from the bottom. The mould was of dry sand, and a pressure head of not less than 10½ in. of metal was applied.

Factors Governing Test-Bar Feeding

MR. BAKER confessed that he could not see any sound fundamental reason for applying so enormous a pressure head on the test-bar. A discussion of the factors governing the feeding of a casting was rather outside the scope of his Paper; but those factors were mainly three, *i.e.*, gravity, namely the pressure of metal in the feeder head above the bar, the atmospheric pressure above the metal in the feeder, and capillary forces acting on feeding liquid towards the end of freezing. The pressure head of 10½ in. of molten bronze was equivalent to about a quarter of an atmosphere. Thus, by imposing that pressure head of metal, one was merely adding a pressure of about 4 lbs. per sq. in. to the pressure of 15 lbs. per sq. in. which already existed. However, it was a very interesting example of a method of casting non-ferrous test-bars.

MR. WILLIAMS added that, without pressure or with only a low pressure, pin-holing occurred; but by applying pressure as he had indicated, that pin-holing was avoided.

MR. E. H. BROWN said quite frankly that he was very much in favour of either the D.T.D. bar or a somewhat close equivalent of it, taken from the American standard cast-iron transverse bar, 14 in. or 16 in. long, 1 in. dia. at the bottom, and 1¼ in. dia. at the top, cast vertically. So long as the mould was dried, one could reduce very much the variables due to differences in running, and could secure fairly consistent results with the bars. The same argument applied to a certain extent to the D.T.D. bar, but it had not the same length. In respect of both kinds of bar, he appreciated particularly the ability to make the moulds separately, to dry them off in an odd corner of a core stove or drying stove, and to use them under fairly constant conditions.

With regard to the bronze star-shaped bar, he had been literally amazed by the variation of results as between one foundry and another. The various foundries might use the same pattern, but there was no standardisation of methods. They all wanted to vary the size of the runner, about which nothing definite had been said. On the other hand, with the open round bar there was a closer approximation to standard conditions.

MR. BAKER did not think that the very long bar

Standardised Test-Bars

which Mr. Brown had described would be found to be satisfactory for non-ferrous metals. He was aware that it had been used for cast iron; but he believed it would be suitable only for certain cast irons which, because they were grey, had very little freezing shrinkage. For most non-ferrous alloys, which had a very high freezing shrinkage, the use of that long bar, virtually unfed, would be out of the question. He hesitated to think of the results that would be obtained if it were used for gunmetal.

MR. BAKER, asking for the view of the meeting on one or two general questions, said that, in the first place, little had been said on the question as to whether or not test-bars should be standardised; did the members want standardisation, or did they prefer to be left to make their test-bars in their own way? Secondly, they had not said much about the amount of metal used in the making of a test-bar or the amount of time spent on making the mould and preparing and testing the specimen. Another problem was that of machining.

Such matters influenced the decision as to the form of test-bar to be used. His own impression was that it was better to do a little extra work in the foundry in making a casting which could be detached easily from the feeder than to produce a casting which required much machining afterwards.

MR. BROWN expressed the view that it was high time all test-bars were standardised throughout the country, and, if possible, throughout the world. With regard to the time spent on moulding and machining, he believed most foundrymen would agree with him that the biggest snag in connection with the production of test-bars was the machining of them. The average foundry was more or less detached from the machine shop, and the less the amount of work left for the machine shop to do, the better for all concerned.

The Test-Bar and the Casting

MR. MANN suggested that the test-bar should give properties representative of those of the casting, and that unless it did so it was useless.

MR. BAKER said, on the general question of how much information a test-bar could give about the casting it represented, there was no question whatever that ordinary forms of test-bar could not indicate the properties of the casting. Those properties depended entirely on the manner in which the casting was run and fed. It would be over-optimism to hope that a test-bar could be evolved which would indicate the properties existing in the actual casting. Therefore, it seemed to him that one must regard a test-bar as an inspection tool, to ensure that the metal was capable of giving the mechanical properties specified. It should be regarded by the inspector as a means of indicating that the material used for making the casting was satisfactory, and contained no harmful impurities. To the foundryman it might have an additional significance as indicating the condition of the metal, particularly its gas content.

He and his colleagues had carried out some work comparing the results from test-bars and from the actual castings, and had found considerable differences. Even after quite an exhaustive series of tests they would not like to offer any specific method by which one could translate tensile test-bar results into the figures which might be expected from the casting.

MR. MANN commented that that was a very serious admission, because surely one wanted some correlation between the properties of the test-bar and of the casting. Otherwise, why make a test-bar? One was more concerned with the properties of the casting than with those of the test-bar.

Mirroring Metal Properties

MR. BAKER could only add that the problem was mainly porosity in the casting, due to shrinkage or gas. The elimination of that porosity, or the extent to which one could reduce it, depended on the manner in which the metal was melted and the manner in which it was cast and fed. In the making of an intricate casting such as a valve body, in gunmetal, for instance, in many cases it was virtually impossible to feed the casting as well as one could feed a simple selected form of test-bar; therefore, one could not expect the casting to have quite the same properties as the test-bar, although one could expect to make the casting pressure-tight and suitable for its duty. The casting and feeding technique for every casting had to be considered individually, and there were varying degrees to which one could feed the castings. It was fairly obvious that one could not evolve a test-bar which was representative of all of them. Nowadays the general view was that a test-bar did not represent the mechanical properties of the casting. It was merely an index of the quality of the metal. It indicated that the material was the proper material and was capable of giving the required mechanical properties. One might know from experience that a casting of a particular form, and made in a certain manner, would give 80 or 90 per cent. of the values given by the test-bar. That was a matter for the foundryman to determine by tests on the actual casting, if such information was imperative.

MR. DUNLOP commented that surely, if the results of tests on the bar were poor, one would expect the casting to give poor results, even though the casting was properly fed. One would not expect the casting to be perfect, in those circumstances.

Troubles from Non-Co-operation

MR. MOCKREY, who had been concerned particularly with jobbing foundries since the beginning of the war, said that if a standard method of providing test-bars had been publicised, it would have saved the jobbing foundries, and himself, a great deal of trouble. Before the war the average jobbing foundry was not very much concerned with test-bars, and many of them would not then have touched manganese bronze; but during the war they had been concerned, through no fault of their own, with high-duty alloys, and had had to make castings in manganese bronze. Test-bars had

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given hopeless results, and many complaints had arisen. If we had been less democratic and had made them join the I.B.F., they would have gained much help from the meetings. He appreciated the great benefit to be derived from such discussions. But many small jobbing founders were unable to get to the meetings; had they been able to do so, they would have gained some idea of what to expect at the beginning of the war.

Jobbing foundries had been producing castings in bronzes from gunmetal to the high-tin bronzes, as well as high-phosphorus and other bronzes. If test-bars were to be standardised, he would advocate, for the general run of bronzes, the D.T.D. type, modified. He had found it very satisfactory, not only from the point of view of mechanical properties, but also from the points of view of the metal involved, the fettling, and various other factors which were fairly obvious. For the high-shrinkage alloys, such as manganese bronze and aluminium bronze, as well as the high-tensile phosphor bronze, he advocated the solid "V" shape or Keel bar. In his experience that bar had proved the best for that type of alloy.

Vote Taken

The CHAIRMAN asked for the opinion of the meeting as to whether a standard test-bar was really necessary. (On a show of hands the meeting voted *nem. con.* in favour of the adoption of a standard test-bar.)

MR. CALLIS recalled the general discussion of the Institute of Metals in 1932 upon "The Testing of Castings," opened by Dr. Rosenhain, when the question of separately cast and attached test-bars was dealt with at length. A strong case, backed by fact and authoritative opinion, was made for the separately cast test-bar.

MR. BAKER commented that it was a pity that official notice had not then been taken of the opinions expressed during that discussion.

The Tensometer Bar

MR. H. TAYLOR asked why, if small bars gave accurate results, metal should be wasted in making larger bars.

MR. BAKER said it was not a question of wasting metal. One must have a test-bar which, in cross-section, was roughly representative of the average run of castings, and he had suggested that the 1-in. round bar was somewhere near the mark. It seemed unnecessary to take out a tensometer specimen and cut out a section in the case of an ordinary casting. There was a much better case for taking out a tensometer specimen for a die-casting.

The CHAIRMAN, enlarging upon the point that the die-castings industry used tensometer pieces, said that in the past they had been in the habit of taking the standard 0.564-in. dia. bar to test the properties of the metal. But the actual castings were found to have very much higher strengths than the test-bars; figures as high as 55 or 60 tons per sq. in. were obtained from some die-castings, whereas the appropriate bars gave figures of about 45 tons per sq. in.

He believed a committee would be formed in this country shortly to decide upon a standard form or standard forms of test-bar; it would be composed of representatives of industry, of the Institute of British Foundrymen and of the Services. Probably he would be representing the Non-Ferrous Sub-Committee of the Institute, and Mr. Baker's Paper would be useful as a basis for discussion. The views of the foundrymen present at the meeting would also be a help to him.

Summarising the results of the discussion, he said that in the first place it had been agreed that standard bars seemed to be necessary. The meeting agreed also that two types of bar would be required, one of which was the Keel bar. The chairman commented that we did not seem to be able to get away from that for the high-shrinkage alloys, and added that the Keel bar should be modified, if necessary, to make it more amenable to the ordinary production of the alloys of lower shrinkage, with a view to securing easier cut-off. As a basis the Canadian report seemed to meet the bill, and he asked that the meeting should state any objections there might be to it. It seemed that the modified Keel bar was the only one upon which some discussion might arise.

(The question arose as to whether or not the problem of cutting off the bar was a big one for the foundry, and one or two speakers indicated that it was.)

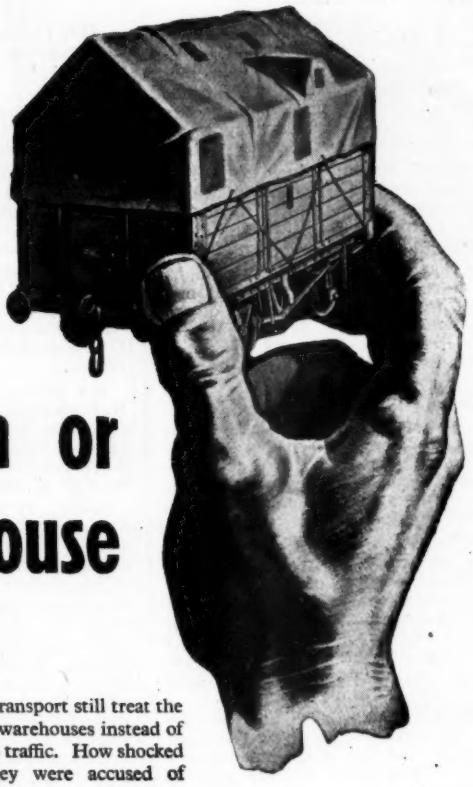
MR. LEE said that one of the factors which made for the success of the Crown bar was that only the skin was taken off and the greater part of the sound metal on the outside was left on the bar, so that one obtained the best properties of the bar.

The CHAIRMAN emphasised the importance of reducing machining to the minimum, as indicated in the discussion, and said that where one had to deal with only one or two Keel bars per day, it might not matter very much; but where a quantity had to be dealt with and a machine was more than fully occupied in cutting test-bars, it was a serious matter. Machines were not so easily obtained in wartime as in peacetime; the use of the Keel-type bar by firms producing large quantities of bars nowadays would be a very serious handicap, and its design must be such that it would cost no more than the ordinary common type used for gunmetal, phosphor bronze, and so on.

Vote of Thanks

A vote of thanks to Mr. Baker for his Paper was proposed by Mr. Faulkner, who referred to him as an ideal lecturer, one who was engaged in research and could at the same time talk the foundrymen's language. Mr. Partridge, seconding, said it would appear, from the number of bars that had been illustrated, that it would not be easy to decide on standard designs. But he was sure that the Research Association would make some sound recommendations.

MR. BAKER, responding, expressed his indebtedness for the suggestions and comments made in the discussion, and said he was gratified that the members of the London Branch, without exception, agreed that it was high time something was done in the direction of standardisation.



Wagon or warehouse ?

TOO many users of transport still treat the nation's wagons as warehouses instead of putting them back into traffic. How shocked they would be if they were accused of obstructing the war effort.

"One wagon out of tens of thousands!"

"It was only three days at our sidings."

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Issued by the Ministry of War Transport

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1 CLEAR LABELS AND DOCUMENTS.
2 LABOUR SAVING DEVICES.
3 WORK IN BLACK-OUT AND AT WEEK-ENDS.
4 OPINIONS OF "MEN WHO DO THE WORK".

I

NEWS IN BRIEF

THE MECHANISED plant of the Phœnix Foundry, Limited, of Johannesburg, will be in full production next month and will operate ten moulding machines.

THE U.S. WAR PRODUCTION BOARD has informed American manufacturers of aluminium and magnesium castings that the existing production capacity is adequate, except in certain instances.

A SECTION of the South African Branch of the Institute of British Foundrymen has been formed in Cape Town. Twenty-five members have been enrolled as well as two subscribing firms. The chairman is Mr. L. Rowley and the secretary Mr. K. Zwanziger.

THE FAN MANUFACTURERS' ASSOCIATION, LIMITED, has been registered as a company limited by guarantee, without share capital, to promote the interests of producers of industrial fans. The first directors are Mr. J. W. Gibson, Mr. G. R. Thursfield, and Mr. G. L. Copping. The offices are at 23, Queen Street, London, W.C.1.

THE FEBRUARY ISSUE of the "Nickel Bulletin" contains abstracts on electrodeposition of nickel-copper and other alloys, an improved corronizing process, methods of sorting mixed steels, an emergency heat-resisting alloy and austenitic electrodes for repairing values. Copies may be obtained free of charge from the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

AN AMALGAMATION OF INTERESTS has taken place between Dualloys, Limited, of Croydon, bearing manufacturers, and the Exactor Control Company, Limited, of London. Mr. J. W. Warrington, director and general manager of the latter company, has joined the board of Dualloys, Limited, and has been appointed managing director. Mr. Warrington was until 1942 chief engineer to the Glacier Metal Company, Limited.

MR. J. GIBSON KERR, general secretary of the Scottish Council on Industry, in an address in Glasgow, said that Scotland needed and must get the newer and lighter industries. The Government and the Scottish Council could encourage industries, but in the end what was clearly required was initiative, efficiency, and hard work. A large development of Britain's export trade would be a necessity after the war, and this alone would give Scotland a great opportunity to export the products of the brains and hands of the workers instead of exporting the workers themselves, as had been done in the unfortunate past.

RUMANIAN RESERVES OF CHROMIUM ORE are small, the principal deposit being in the Banat between Dobora and Ogrodina. This deposit is estimated at 2,000,000 tons of ore containing between 38 and 52 per cent. Cr. Manganese ore reserves are put at about 7,000,000 tons, of which 5,500,000 tons is located in Moldavia. The ore extracted in this region and in the Bukovina averages between 15 and 46 per cent. Mn, the content of metal being very variable. Rumania is the principal producer of manganese ore in Europe outside the Soviet Union, and up to recently sold fair quantities of the ore to Germany and Italy.

PERSONAL

MR. JAMES H. LANSING has been appointed consulting engineer to the (American) Malleable Founders' Society, in succession to the late Prof. Enrique Touceda.

DR. CHARLES SYKES, F.R.S., who succeeded the late Dr. W. H. Hatfield as principal of the Firth-Brown Research Laboratories, Sheffield, has been appointed a director of Thomas Firth & John Brown, Limited.

MR. FRANK BIRD, who is a director of Jarrow Metal Industries, Limited, has been appointed to the board of Sir W. G. Armstrong Whitworth & Company (Iron-founders), Limited, Close Works, Gateshead-on-Tyne.

MR. WILLIAM J. LOVE, sales manager of the Etna Iron & Steel Company, Limited, Motherwell, has completed fifty years' service with the company, and has received a presentation from his fellow directors. Mr. Love joined the firm in 1894, and became a director in 1928.

MR. DOUGLAS M. NICOL, formerly of A. R. Brown, McFarlane & Co., Limited, Glasgow, has been appointed a director of Whyte & Edwards (Metals), Limited, non-ferrous metal founders, Dundee, to fill the vacancy caused by the death last January of Mr. Richard M. Edward.

MR. C. F. K. HAGUE, deputy managing director of Babcock & Wilcox, Limited, has been appointed member for Great Britain on the Public Utilities Committee, which is dealing with the problem of re-establishing electric, gas and water services in liberated and conquered countries. Mr. Hague will shortly be leaving to take up his duties in Washington.

SIR JOHN CRAIG, chairman and managing director of Colvilles, Limited, was presented at Motherwell, on March 4, by employees of the firm and associated companies, with his portrait in oils to mark the knighthood conferred on him in June last. Mr. William Mawer, of the Dalzell Works, Motherwell, an Executive member of the Iron and Steel Trades Confederation, presenting the portrait, painted by Hugh Crawford, of Glasgow, pointed out that Sir John had started work there 56 years ago. A silver chalice was presented to Lady Craig.

DR. R. N. ARNOLD has been appointed Professor of Engineering at the University College of Swansea in succession to the late Prof. Frederic Bacon. Mr. Arnold was born in Glasgow in 1908. He held a Commonwealth Fund Fellowship at the University of Sheffield, and later won the gold medal of the Institution of Engineers and Shipbuilders in Scotland, the Dr. James Mackenzie Prize for Research, and the Thomas Lowe Gray Prize of the Institution of Mechanical Engineers. Since 1940 he has been at the Metropolitan-Vickers research department.

Wills

RALPH, J. J., of Wolverhampton, iron and steel merchant	£66,991
SCOTT, THOMAS, of Kelso, Roxburghshire, late a director of George Henderson, Limited, Kelso Foundry	£3,318

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COMPANY RESULTS

(Figures for previous year in brackets)

Thos. W. Ward—Interim dividend of 3¼% on the ordinary shares.

Bairds & Dalmellington—Net profit for 1943, £230,791 (not £270,791, as stated in our last issue).

Thomas Robinson & Son—Profit for 1943, £31,155 (£30,934); ordinary dividend of 7½% (same); forward, £40,918 (£37,632).

Baldwins—Net credit balance for 1943, after charging taxation, £383,659 (£330,939); dividend of 10% on the ordinary stock (same).

Zinc Corporation—Interim participating dividend of 1s. per share (same) on the preference and ordinary shares, less tax at 5s. 3d. in the £.

Davies & Metcalfe—Net profit for 1943, after tax and depreciation, £14,570 (£14,265); dividend of 11% (same); to general reserve, £2,500 (same); forward, £2,838 (£2,268).

Cammell Laird—Net profit for 1943, after providing for depreciation, debenture interest, sinking fund, taxation and contingencies, £199,292 (£192,122); to general reserve, £100,000 (same); ordinary dividend of 10% (same); forward, £116,525 (£105,983).

Bruce Peebles—Profit for 1943, after making provision for income-tax and E.P.T., war damage insurance, etc., £39,737 (£39,565); to depreciation reserve, £20,000 (£19,000); preference dividend of 7½% and a further participating dividend of 2½%, making 10%, £5,107 (same); ordinary dividend of 5% and a bonus of 3%, making 8%, £14,223 (same); forward, £12,282 (£11,875).

Lancashire Steel Corporation—Net profit for the ten months to October 31, 1943, after providing for taxation liability, £458,646 (£514,509 for 1942); depreciation of fixed assets, £170,000 (£200,000); reserve for deferred repairs and maintenance, £65,000 (£60,000); war damage premiums, £18,501 (£32,817); general reserve, £50,000 (£35,000); staff fund, £4,672 (£5,606); dividends on the 5% preference and 5½% non-cumulative second preference shares and a dividend of 7% per annum (same) on the "A" and "B" ordinary stocks, £148,430 net; forward, £85,727 (£84,684).

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Refractory Specialities, High Street, Kingswinford, Staffs—£1,500. K. J. G. MacMaster.

Pease Pottage Engineers, Pease Pottage, Crawley, Sussex—£2,000. A. Penfold and W. J. C. Belt.

Brickhouse Foundry, Brickhouse Lane, West Bromwich, Staffs—£1,000. R. A. E. and M. E. Godfrey.

H. L. Halstead & Company, 33, Newington Green, London, N.16—Engineers. £3,000. H. L. Halstead.

Jone-Hawk Engineering Company, 22, Waterloo Road, Wolverhampton—£5,000. J. W. and W. K. Jones.

Robert Harris, Waddens, Brook Estate, Wednesfield, Staffs—Engineers, etc. £6,000. R. W. Harris and K. G. Siddaway.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

558,661 ADAPTABLE MOULDING MACHINE COMPANY, LIMITED, and GARDOM, J. W. Foundry gantries, overhead runways and the like.

558,716 BIRMINGHAM ALUMINIUM CASTING (1903), COMPANY, LIMITED, and PRITCHARD, P. Method of casting metal articles.

558,717 BIRMINGHAM ALUMINIUM CASTING (1903), COMPANY, LIMITED, and PRITCHARD, P. Means of casting metal articles.

558,722 BERK & COMPANY, LIMITED, F. W., and MEHL, E. Process for the manufacture of copper powder.

558,792 PYRENE COMPANY, LIMITED, and CLIFFORD, W. J. (Parker Rust-Proof Company in part). Coating of metal surfaces.

558,810 RENNERFELT, I. Methol of producing shaped objects from carbon-holding iron nickel or cobalt.

558,832 BIRMINGHAM ALUMINIUM CASTING (1903), COMPANY, LIMITED, and PRITCHARD, P. Discharge valves of metal melting and metal holding furnaces.

558,873 JOHNSON, MATTHEY & COMPANY, LIMITED, ASHBY, C. L. G., and CHASTON, J. C. Silver solder alloys.

558,925 BOWEN, E. WINDSOR-. Electrolytic treatment of aluminium and aluminium base alloys.

558,926 BOWEN, E. WINDSOR-. Treating aluminium and aluminium base alloy surfaces in preparation for applying an adherent coating to them.

DARWINS ACQUIRE WARDSEND STEEL COMPANY

Darwins, Limited, Sheffield, have acquired the share capital of the Wardsend Steel Company, Limited, also of Sheffield. Prior to the war Darwins acquired Andrews Toledo, Limited. The Wardsend Steel Company has hitherto been owned and controlled by Mr. W. W. Wood, the present Master Cutler of Sheffield. Mr. Wood will join the boards of Darwins and Andrews Toledo, whilst remaining a director of Wardsend Steel. Mr. William J. Wigney, managing director of Darwins, has been appointed chairman of the Wardsend Steel Company. Mr. Alan P. Good remains chairman of Darwins, the parent concern. The acquisition of Wardsend Steel Company by Darwins has been financed within the existing cash resources.

CONTRACT OPEN

The date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Redcar, March 20—Iron castings, cast and spun iron pipes, etc., during the year ending March 31, 1945, for the Town Council. The Borough Engineer, Municipal Buildings, Redcar.

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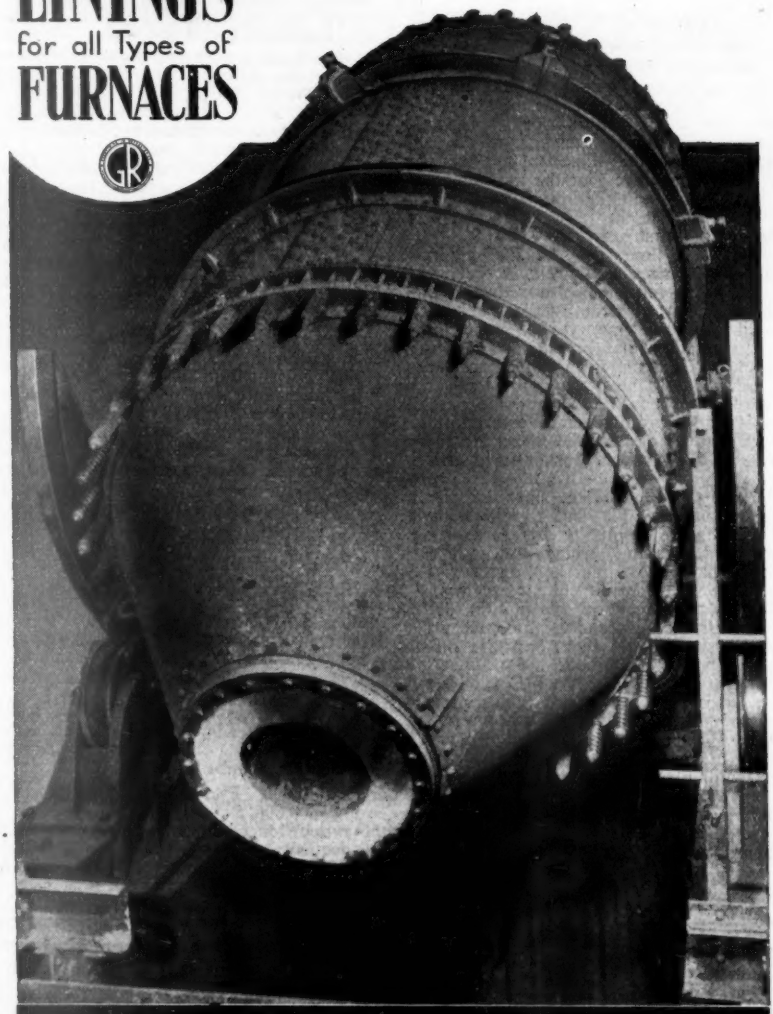

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Raw Material Markets

IRON AND STEEL

Some curtailment of pig-iron production cannot be ruled out of court, and it is fortunate that many consumers have been able to accumulate quite impressive reserve stocks. The authorities cannot at present release supplies for other than priority purposes, owing to the need to conserve transport, which is a dominating factor during the present stage of the world conflict. It is imperative that the movement of heavy traffics such as ore and pig-iron be reduced to the minimum, so as to free the railways as much as possible for the coming emergency.

For some considerable time past stocks of pig-iron have been steadily increasing. Slackness in the light-castings trade has been reflected in a reduced consumption of high-phosphorus iron, while steelworks have accumulated substantial reserves of basic iron. Hence it is not surprising that production of these grades is being curtailed, apart from other considerations. On the other hand, the demand for low- and medium-phosphorus iron is fairly constant, the output of refined iron is going promptly into consumption, and the continued scarcity of hematite makes it necessary to maintain the rigid supervision of its distribution.

Deliveries of home-produced billets, slabs and sheet bars are still somewhat variable, but re-rollers have sufficient stocks to ensure immunity for some time from any inconvenience arising through transport delays. All the mills have substantial bookings for the second period, and it would be difficult, if not impossible, to place orders for execution this month. The call for sheets has assumed especially impressive proportions, but, curiously enough, sheet bars are more readily obtainable than prime billets.

Production of light structural sections is still on a substantial scale, but is rapidly overtaking the demand and orders can now be placed with the prospect of fairly early delivery. Interest in heavy sizes, of course, has long been at a low ebb and mills have been diverted to the rolling of other products. Marine and electrical engineers provide strong support for the steel industry, but the heaviest calls still emanate from the shipyards, whose consumption of plates and angles is still rising. Thus, any signs of waning activity do not extend to the plate mills, outputs being booked four to six months ahead.

NON-FERROUS METALS

The Board of Trade has proposed that, as a wartime measure, a limited amount of aluminium hollow-ware should be manufactured in South Wales. Although this industry has long been associated with Birmingham, it appears that the Government are considering the post-war period in taking the industry to South Wales, which is still technically known as a distressed area. Manufacture of aluminium hollow-ware is also to be started in Scotland. No aluminium vessels for domestic use have been produced since the beginning of the war, and the demand is likely to absorb the entire production. This scarcity must have been considerably increased by the collection of household aluminium to ease the tight supply situation which existed in the earlier stages of the war. The position has now been completely reversed, and even though production of hollow-ware may only cover a very small percentage of the country's needs, it shows that aluminium is in favourable supply and that a surplus exists after war production requirements have been satisfied.

The tin situation is reasonably satisfactory when it is taken into consideration that consumption has had to be cut by half in order to bring it within range of the supplies now available. Priority undertakings are getting all the metal that they need, but no releases are likely to be made to other than essential works.

At the moment there does not seem to be much lead to spare, as most of the available supply is absorbed for military purposes. Lead will be in intensive demand for the construction of new houses after the war, but, although a certain amount of lead is being used in the repair of bomb-damaged buildings, it is unlikely that the Control will make any large-scale concessions before the closing stages of the war.

MR. E. B. MARSTON secretary of Richmonds Gas Stove Company, Limited, and Fletcher Russell & Company, Limited, has been elected president of Warrington Chamber of Commerce.

THE OXLEY ENGINEERING COMPANY, LIMITED, is issuing 300,000 5s. ordinary shares at 8s. 6d. each in the proportion of three for every four held to finance the acquisition of the business of Thomas Dryden & Sons, Limited, mechanical and electrical engineers and iron and brass founders, of Preston.

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